

Engineering and Qualification of Thin-Ply Composites, Phase I

Completed Technology Project (2018 - 2019)

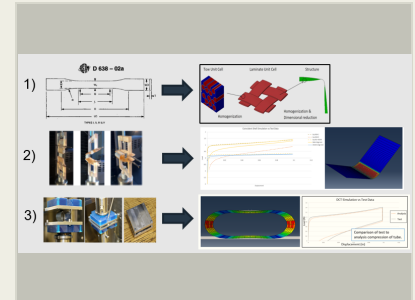


Project Introduction

This body of research focuses on developing fundamental engineering qualification methods for Thin-Ply High Strain Composites (TP-HSCs). Roccor will collaborate with NASA and Dr. Kwok of the University of Central Florida to develop and validate a robust framework for engineering the viscoelastic behavior of highly strained thin-ply composites. The material systems studied will be highly focused on the matrix contributions to thin ply composite structures, where the fibers utilized will be IM7 and the layup type will be spread-tow plain weave with a maximum of 80 grams per square meter. The ultimate goal of this research is to develop a robust analysis and prediction method which is matrix agnostic, however with the timeframe of a phase one contract the initial study will only utilize Patz Materials Technologies – F7 (PMT-F7) toughened, high temperature, epoxy resin. Performance tasks of this program include neat-resin test, Column-bend Test, and diametrical compression testing. Each test will aid in the development of robust analytical methods as well as material allowable databases made available to the public. Further investigation in a phase two effort would validate the framework and publish test data for a representative sample of space-flight-grade resin types including at least one other epoxy, cyanate ester, thermoplastic (e.g. PEEK, PEKK), and at least one system with a nano-filler.

Anticipated Benefits

- Development of Engineering methods for qualifying deployable structures that utilize Thin-Ply High Strain Composites (TP-HSCs)
- Expansion of engineering materials database concerning Thin-Ply composites
- Reduced risk factor for TP-HSC deployable structures
- Reduced cost to deployable structures programs due to robust engineering methods
- Commercial company access to engineering materials database
- Industry realization of TP-HSCs cost savings capabilities
- Increased utilization of TP-HSCs in high volume constellations due expanded confidence in material properties and analytical prediction capabilities
- Increased utilization of TP-HSCs in high volume constellations due to simplicity of design



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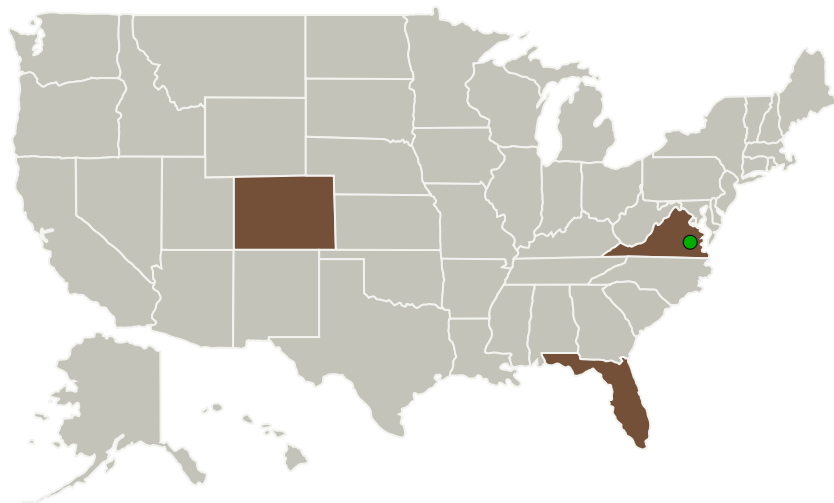
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Roccor, LLC	Lead Organization	Industry	Longmont, Colorado
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia
University of Central Florida(UCF)	Supporting Organization	Academia Hispanic Serving Institutions (HSI)	Orlando, Florida

Primary U.S. Work Locations

Colorado	Florida
Virginia	

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Roccor, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

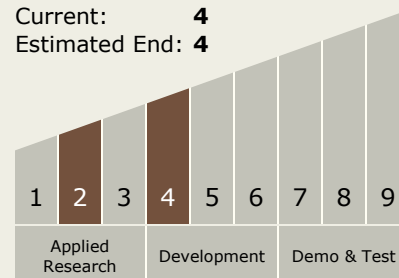
Carlos Torrez

Principal Investigator:

Tj Rose


Technology Maturity (TRL)

Start: 2
 Current: 4
 Estimated End: 4





Project Transitions

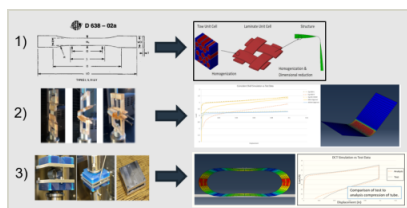
 **July 2018:** Project Start

 **August 2019:** Closed out

Closeout Documentation:

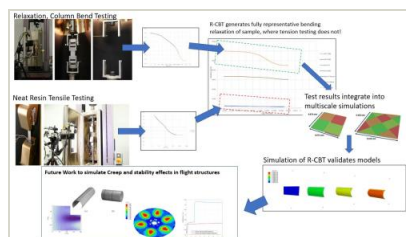
- Final Summary Chart(<https://techport.nasa.gov/file/141333>)

Images



Briefing Chart Image

Engineering and Qualification of Thin-Ply Composites, Phase I
(<https://techport.nasa.gov/image/131041>)



Final Summary Chart Image

Engineering and Qualification of Thin-Ply Composites, Phase I
(<https://techport.nasa.gov/image/130095>)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - TX12.1 Materials
 - TX12.1.1 Lightweight Structural Materials

Target Destination

Foundational Knowledge